
Measurements of Black Carbon in Chicago Urban Area

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Abstract

Measurements of black carbon were taken in an urban area of Southern Chicago. Using an Aethalometer, data was collected continuously for one week. The data showed patterns of increased concentration during the heaviest traffic hours, suggesting that vehicular exhaust is the primary generator of black carbon in the area.

Introduction

- Aerosol Black Carbon or soot, is formed in all combustion of carbon fuels.
- Has a small particle size (<1micrometer).
- Its graphitic microstructure is black.
- Is inert and thus, once in the atmosphere the only mechanism for removal is deposition.

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- Not very soluble in water.
 - The surface of the particles may be covered with functional groups which might be chemically active.
 - Black carbon emissions depend on the quality of the combustion process and therefore, they cannot be predicted; they have to be measured.

Reasons for Measuring Black Carbon

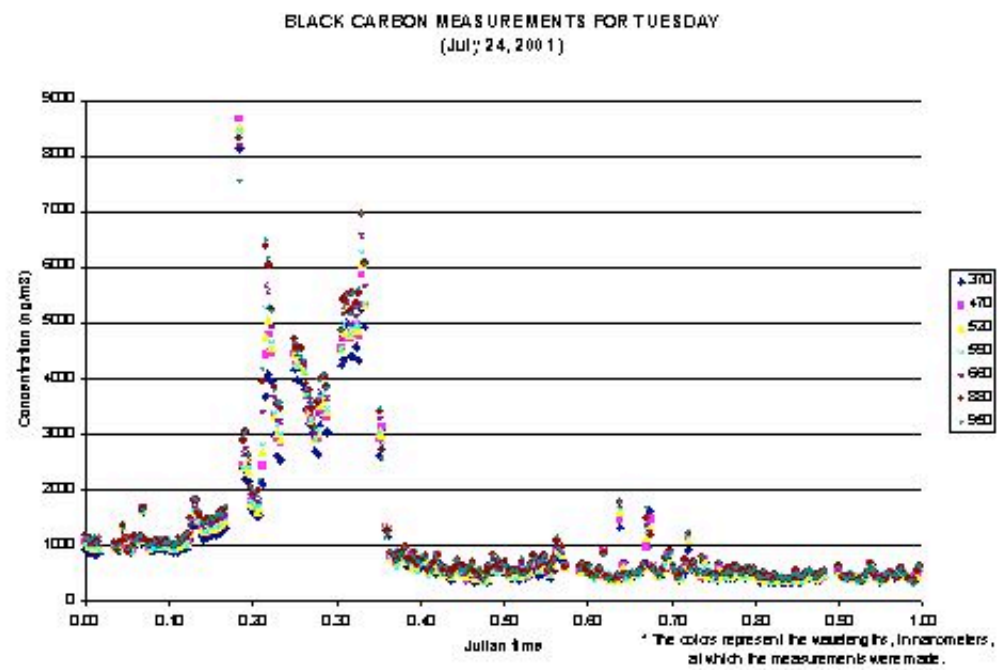
- Black carbon is a primary aerosol.
- The adherence of functional groups and its highly porous surface make it a source of transportation for other chemical species.
- Being inert and insoluble, it is a good age-dating agent, which could help predicting long range transport mechanisms.

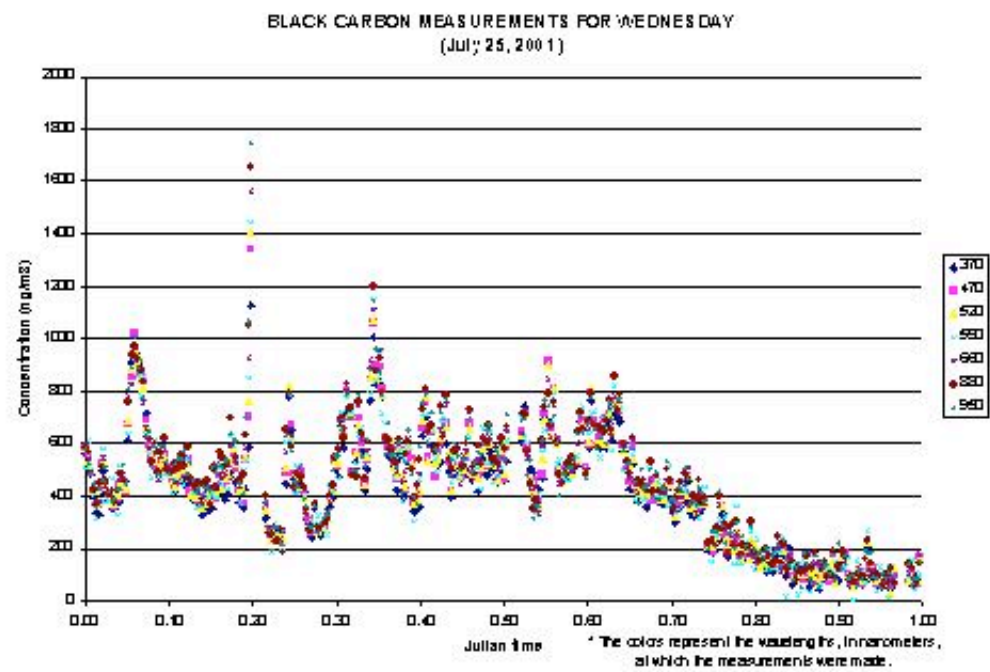
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- Black carbon may play an important role in climate change in two possible ways: as a dispersing agent, scattering in coming radiation, or as an absorber, reducing the amount of photons available and thus affecting the photochemistry.
 - This effects may cool or heat the planet.

Instrumentation

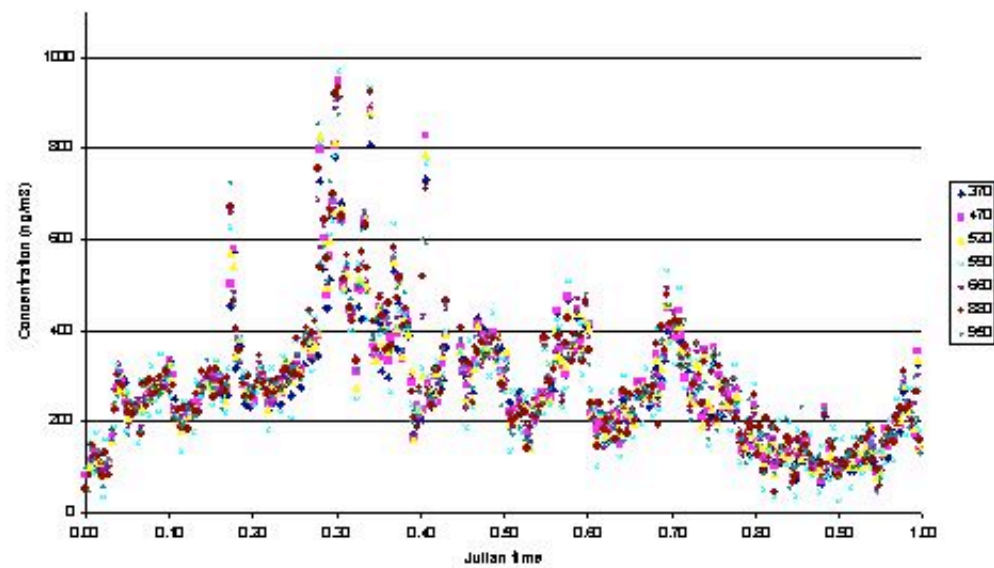
- The instrument used to make the black carbon measurements was the “Spectrum” Aethalometer.
- The instrument samples air and passes it through a filter which collects black carbon. The amount of black carbon is then measured photometrically by radiation absorption at 7 wavelengths.

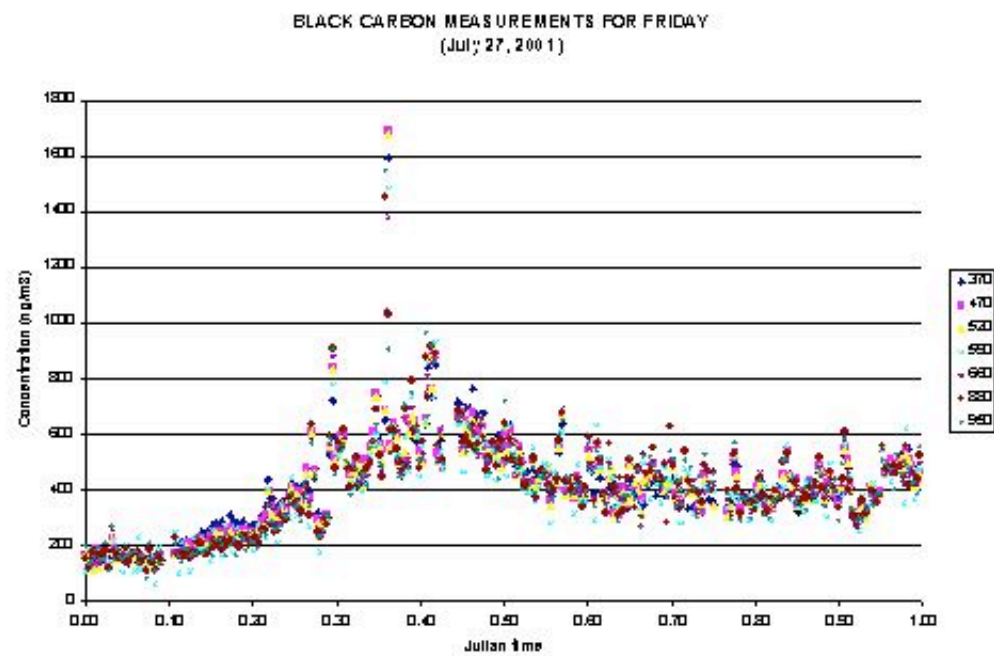
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- The Aethalometer operates automatically.
 - The measurements were taken in the southern urban area of Chicago known as Hyde Park.
 - It was stored in the 5th floor of a building (in the University of Chicago) where it took measurements every 5min.

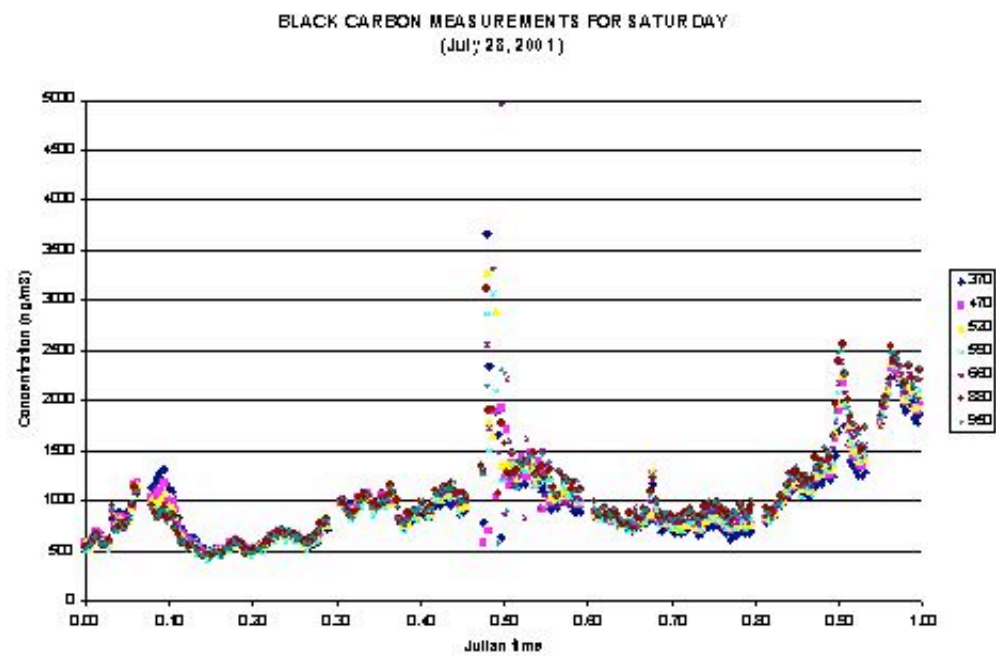


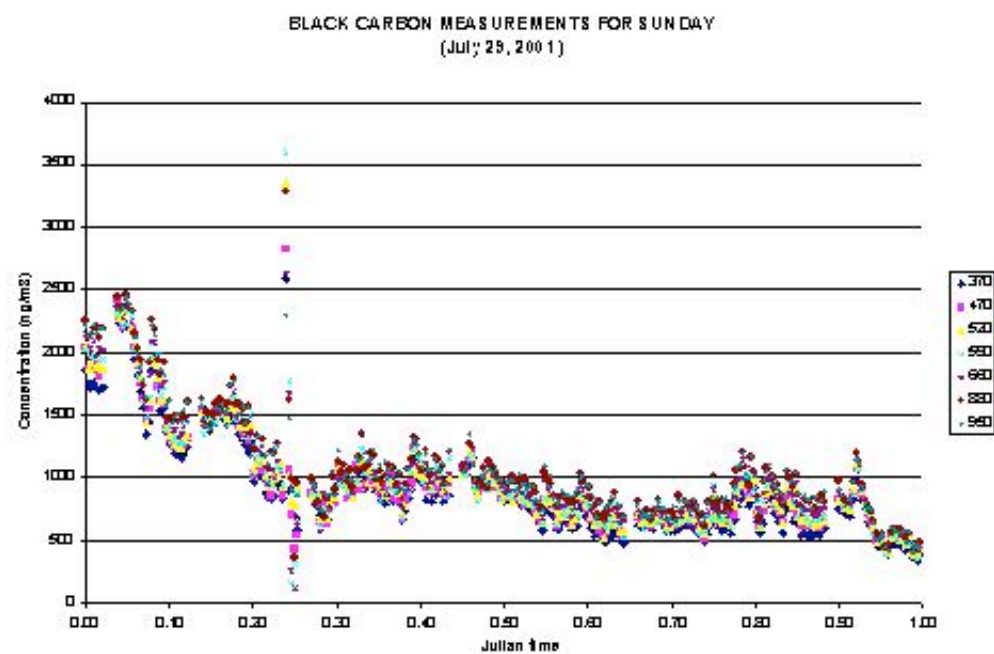


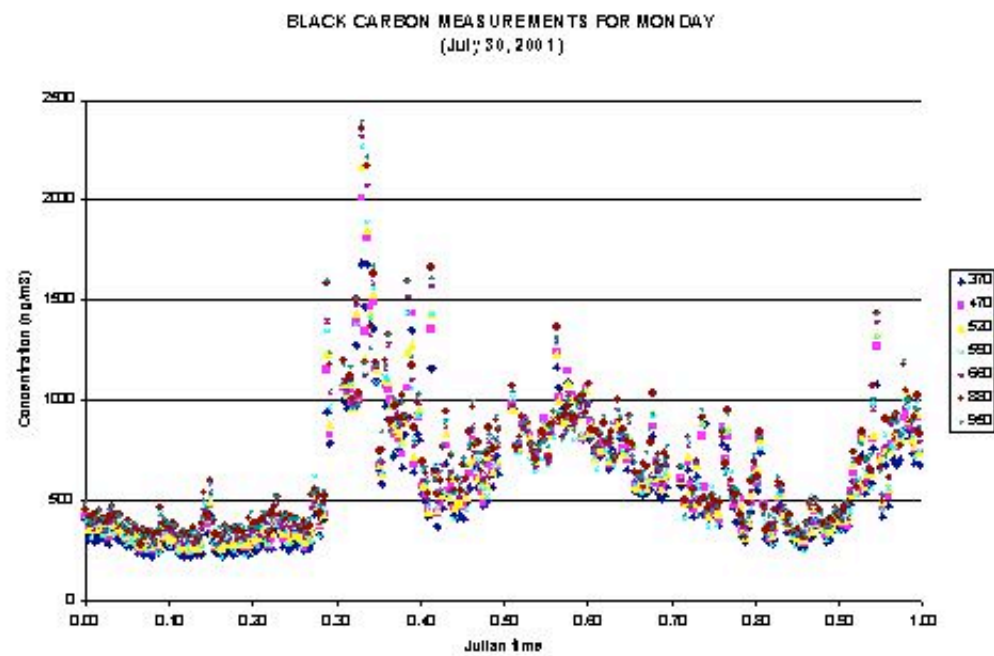
BLACK CARBON MEASUREMENTS FOR THURSDAY
(July 26, 2001)

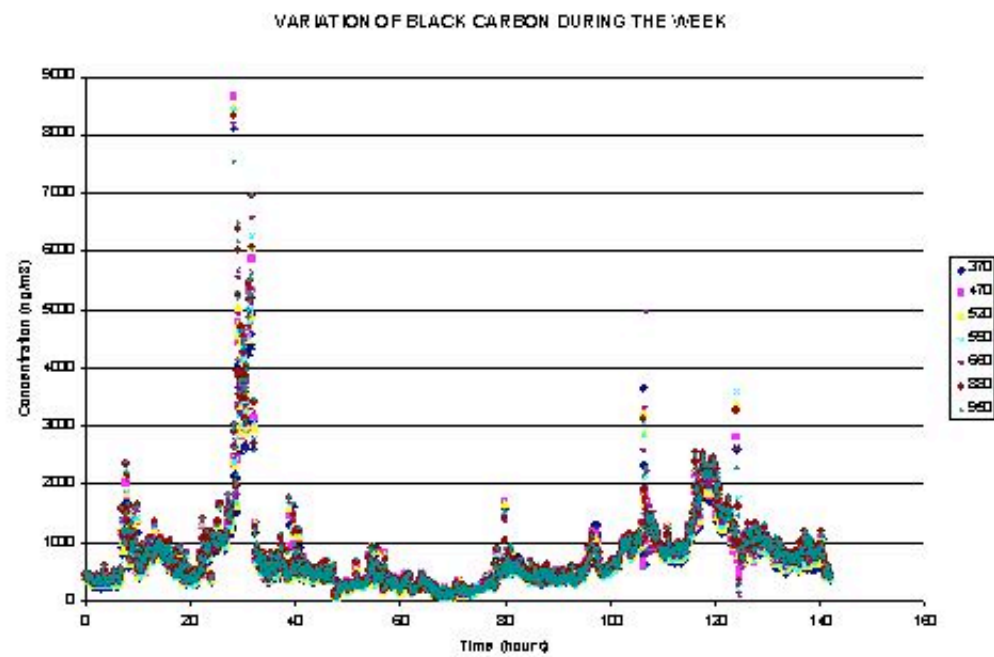












Discussion

- The graphed data gives a good general idea of the fluctuation of black carbon during the day and week.
- Some peaks are observed consistently during the weekdays between 4:00am and 7:00am (0.2 and 0.3 Julian time), and 7:00am and 9:00 (0.3 and 0.4 Julian time).

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- The concentrations of black carbon observed varied from day to day, including that of the regularly observed peaks.
 - There is no distinguishable pattern during the weekend.
 - Saturday presents a high peak at noon while Sunday's peak observed early.

Conclusions

- The peaks observed during the weekday coincide with the morning rush hours. This indicates that the emissions of black carbon are generated by the vehicles.
- Since those rush hours are not seen during the weekends, it is logical that the peaks are not observed.

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- The peak observed during the early morning of Sunday was probably caused by instrument malfunction, since at the same time is showing very low readings.
 - The variation in concentration cannot be explained since factors like meteorology have not been examined.

References

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